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Draft SFWMD Water Supply Contingency Plan

August 21, 2001

South Florida Water Management District

Water Supply Department

South Florida Water Management District
Water Supply Contingency Plan

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I. INTRODUCTION AND BACKGROUND

Since November, 1999 South Florida has experienced the most severe drought conditions of modern times. The year 2000 was the driest year since 1938. The period from November, 1999 through May, 2001 was the driest sequence of dry-wet-dry seasons ever recorded. In response to these conditions, water use restrictions were implemented over a large portion of the South Florida Water Management District (District or SFWMD).

The agricultural water users within the Lake Okeechobee Service Area have been operating under Phase III Supply Side Management since November 29, 2000. During this period, growers have received less than 50% of the supplemental irrigation demand. Agricultural water users in the C-23, C-24, C-25 and Indian Prairie basins have been restricted from withdrawing water when canal levels have fallen below established minimum levels.

Phase II and Modified Phase II water use restrictions have been imposed in the urbanized areas of the entire Lower West Coast Region, Lower East Coast Region and Orlando area since April 2001. The geographic scope of these restrictions is unprecedented in the history of the South Florida Water Management District. Phase II restrictions are designed to reduce overall water use by 30%.

During the summer of 2000, the District developed a Water Supply Contingency Plan (Plan) in response to these emerging conditions. The approach was to develop and analyze a set of options to manage water supply through the upcoming dry season. Many of these options were implemented and refined over the course of the ensuing water shortage. This document represents a refinement and update of the original plan, incorporating many lessons learned during the past year, to prepare for the possibility that the water shortage may extend through the 2001/2002 dry season or beyond.

II. PLAN DEVELOPMENT PROCESS

Preparation of this plan began with a review of the options evaluated in the year 2000 Water Supply Contingency Plan. Options were evaluated based on their continued relevance and applicability. Some options were eliminated, others were combined, and several new options were incorporated into the Plan.

Each option was described and analyzed with respect to implementation factors, costs and benefits. This information was then compiled and combined with a description of the implementation process and funding strategy to produce a draft 2001 Water Supply Contingency Plan. This draft was reviewed internally by the Drought Management Team and then presented to the District Water Resources Advisory Commission for review and comment. It was circulated to other agencies, local governments, utilities and other

interested parties to solicit comments. The final 2001 Water Supply Contingency Plan was then presented to the SFWMD Governing Board in September 2001.

III. PROPOSED OPTIONS

Options proposed for implementation during the 2001-2002 dry season are listed in Table 1.

Table 1. 2001 Water Supply Contingency Plan Options

1. Lake Okeechobee Augmentation and Backpumping
2. Water Conservation Area Schedule Deviations
3. Upper Chain of Lakes Operational Flexibility
4. Cloud Seeding
5. Modified Supply Side Management
6. Restrict BMP Makeup Water Deliveries
7. Water Shortage Triggers
8. Minimize Deliveries to Maintain LEC Canal Levels
9. Diversion and Impoundment Operations
10. Southern Istokpoga Basin Operations
11. STA Operations
12. Water Conservation BMPs For Water Shortage
13. Water Shortage Implementation
14. Forward Pumping Operational Guidelines
15. Comprehensive Water Shortage Public Education Program
16. C-23, C-24, & C-25 Water Shortage Operations
17. Caloosahatchee River At- Risk Utilities
18. Lake Okeechobee At-Risk Utilities
19. Ground Water At-Risk Utilities
20. Water Supply Improvements for C-40 and C-41 Canals
21. Local Government Enforcement
22. District Enforcement

IV. OPTIONS ANALYSIS

A. Option Evaluations

Option descriptions and evaluations are provided as **Attachment I** to this Plan. Each evaluation includes the following components:

1. Option Name and Description

Description of the major components of the option and a summary of expected results from its implementation.

2. Implementation

Description of what actions are needed, by whom, at what locations and when.

3. Timing

The schedule for implementing the option.

4. Benefits and Costs (including impacts)

Evaluation of the monetary and non-monetary benefits and costs of each option.

B. Option Implementation Matrix

An Option Implementation Matrix (Figure 1) was developed to show relationships among the factors that are considered during the decision process. This matrix contains information on the level of water shortage severity that should exist, the appropriate time of year, costs, and benefits associated with implementation of each option. These decision factors are discussed further below.

1. Severity of Water Shortage

Options with a high environmental and/or monetary cost and high water supply benefit may not be appropriate for implementation in a moderate water shortage situation. On the other hand, that same option may be appropriate for implementation in an extreme water shortage situation. Therefore, it is appropriate to evaluate the cost of implementing an option and the potential water supply benefits and environmental impacts that could be realized versus the severity of the water shortage. Each option was evaluated on this basis and categorized into one or more of three groups as follows:

- Options most appropriately implemented during ***moderate*** water shortage.
- Options most appropriately implemented during ***severe*** water shortage.
- Options most appropriately implemented during ***extreme*** water shortage.
- Options most appropriately implemented during ***critical*** water shortage.

The severity of water shortage, as incorporated within the Option Implementation Matrix, is defined based on consideration of the following factors:

a. Lake Okeechobee stage/storage

b. Water Conservation Areas stage/storage

c. Local groundwater and surface water conditions

Other factors that must be considered in evaluating the severity of water shortage include the time of year and the short-term and long-term weather forecasts.

a. Severity Based on Lake Okeechobee Stage/Storage

The definition of the severity of water shortage with respect to Lake Okeechobee is graphically illustrated in Figure 2. The Lake Okeechobee Service Area can be placed in Supply Side Management when lake stage drops below 13.0 feet at the beginning of the dry season and 10.5 feet at the beginning of the wet season. The categories of severity of water shortage based on Lake Okeechobee conditions are related to this Supply Side Management Line. These categories are defined as :

Moderate Up to 0.5 feet below the Supply Side Management line

Severe 0.5-1.0 feet below the Supply Side Management Line

Extreme 1.0-1.5 feet below the Supply Side Management Line

Critical > 1.5 feet below the Supply Side Management Line

Figure 1. Water Supply Contingency Plan Options - Implementation Matrix

Option	Water Shortage Severity[2]			Season to Implement[1]		Costs	Benefits	Other Considerations
	Lake Okeechobee	Water Conservation Areas	Local GW/SW Conditions	wet	dry			
1. Lake Okeechobee Backpump & Augmentation	M, S, E, C	N/A	N/A	x		$855K	371K ac-ft	WQ impacts
2. Water Conservation Area Schedule Deviations	S, E, C	S, E, C	S, E, C		x	Staff time	(34-38% less demand on LO)	MFL violation environ. impacts
3. Upper Chain of Lakes Operational Flexibility	M, S, E, C.	M, S, E, C	N/A	x	x	Staff time	Environ., WQ improve.	Recreation loss environ. benefits
4. Cloud Seeding	C	C	C	o	x	Yr 1: $950K Yr 2: $750K	30-60% rain-fall increase	Ancillary WQ, environ. + flooding
5. Modified Supply Side Man-agement (yellow book)	M, S, E, C	N/A	N/A	o	x	Staff time	More equitable restrictions	MFL violation
6. Revise BMP Makeup Water Deliveries	M, S, E, C	M, S, E, C	M, S, E, C		x	Staff time	160K ac-ft	STA, WQ impacts
7. Water Shortage Triggers	M, S, E, C	M, S, E, C	M, S, E, C	x	x	$80K admin	Resource-based trigger	Changes in value of water; user impacts
8. Minimize Deliveries to Maintain LEC Canal Levels	S, E, C	S, E, C	M	o	x	Lower op. cost; High poss. impact	40K ac-ft + environ. benefits	MFL violation SW intrusion
9. Diversion and Impoundment Operations	S, E, C	S, E, C	S, E, C	o	x	Poss. local ag impacts	12K ac-ft/day + environ. benefits	
10. Southern Istokpoga Basin Operations	M, S, E, C	N/A	M, S, E, C	o	x	$48K pump costs	4K ac-ft	
11. STA Operations	M, S, E, C	M, S, E, C	M, S, E, C	o	x	(saves money)	35K ac-ft	STA vegetation, WQ impacts
12. Water Conservation BMPs For Water Shortage	M, S, E, C	M, S, E, C	M, S, E, C	x	x	varies	Up to 50% of demand	
13. Water Shortage Restrictions	M, S, E, C	M, S, E, C	M, S, E, C	x	x	$300-15000 per ac-ft	10-50 % reduction	Local Government responsibility
14. Forward Pumping	S, E, C	S, E, C	S, E, C	o	x	$2.5M+op and maintenance	266K ac-ft	Lower lake levels
15. Compr. Water Shortage Public Education Program	M, S, E, C	M, S, E, C	M, S, E, C	o	x	$1M	10-50% of PWS demand	
16. C-23, C-24, & C-25 Water Shortage Operations	N/A	N/A	E, C	o	x	Varies	.5 to .8K ac ft	Time to Implement
17. Caloosahatchee River At-Risk Utilities	S, E, C	N/A	M, S, E, C	o	x	$ 32 M to local utilities	Less frequent restrictions	Caloosahatchee WQ, MFL violation
18. Lake Okeechobee At-Risk Utilities	E, C	N/A	N/A	o	x	$2M	Reliability to 6 ft	
19. Ground Water At-Risk Utilities	M, S, E, C	M, S, E, C	S, E, C	o	x	Admin, monitor and report costs	Minimize local SW intrus. risk	
20. Water Supply Improvements for C-40 and C-41 Canals	S, E	N/A	N/A	o	x	$450K	34K acre-ft	
21. Local Government Enforcement	M, S, E, C	M, S, E, C	M, S, E, C	x	x	Staff time	Reduced water use	Local Government responsibility
22. District Enforcement	M, S, E, C	M, S, E, C	M, S, E, C	x	x	Staff time	$ collected; red. In water use	

[1] x= preferred; o =optional; [2] Severity is classified s follows: C = critical, E = extreme, S = severe, M = moderate

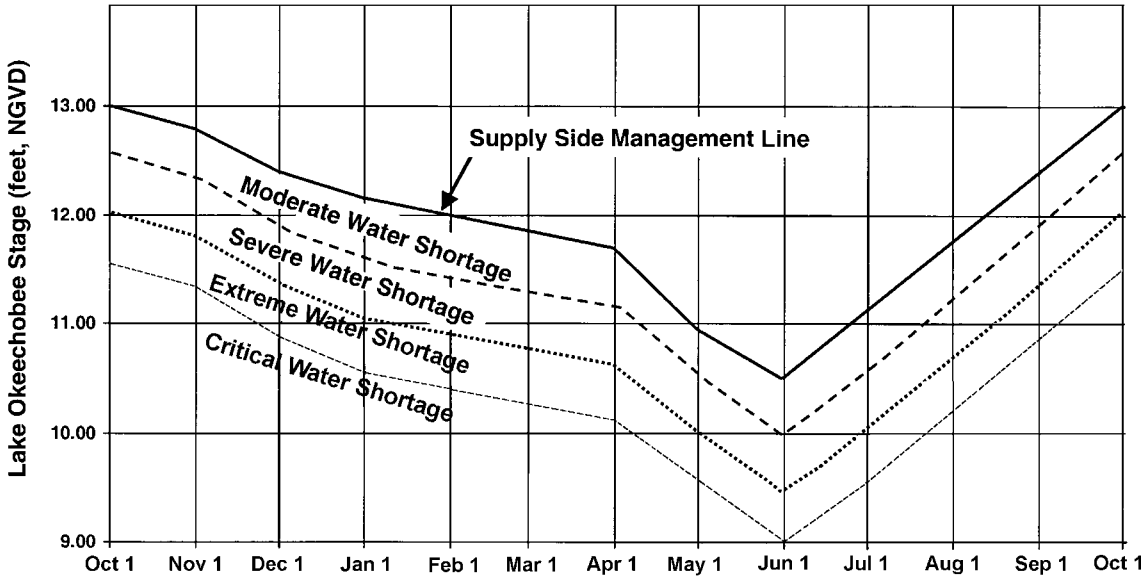

Figure 2. Regional Drought Severity based on the Lake Okeechobee Supply Side Management Line

b. Severity Based on Water Conservation Areas Stage/Storage

The definition of severity of water shortage with respect to the Water Conservation Areas is defined by the potential for stage to drop below the administrative "floor" of the federally-established schedule for each Water Conservation Area. The floor is the stage at which water supply deliveries cannot be made from the Water Conservation Area unless the delivered water is replaced by water from another source. The categories of severity of water shortage for the Water Conservation Areas are defined as:

Moderate Stages falling below the floor late in the dry season

Severe Stages falling below the floor in the middle of the dry season

Extreme Stages falling below the floor near the beginning of the dry season

Critical Stages falling below the floor during the wet season

c. Severity Based on Local Groundwater and/or Surface Water Conditions

Severity of water shortage with respect to local groundwater conditions is related to the localized potential for saltwater intrusion into potable water wellfields. Severity with respect to local surface water conditions is related to the potential for surface water levels to drop below established minimum levels. These categories of severity are defined as:

Moderate Groundwater levels have declined to a degree that the direction of saline groundwater flow shifts toward a wellfield. Local surface water levels are seasonally low but remain above minimum levels.

Severe Groundwater levels have declined to a point where inland movement of saline water is occurring, but not to the degree that the quality of groundwater being withdrawn at a wellfield is being affected. Local

surface water levels are seasonally low but remain above minimum levels.

Extreme Groundwater levels have declined to a point where saline water may move into a wellfield. Local surface water levels are below minimum levels.

Critical Potable water facilities utilizing groundwater cannot meet primary drinking water standards due to saltwater intrusion. Local surface water levels are below minimum levels.

2. *Season to Implement the Option (Timing)*

Implementation components of the various options were further categorized to determine whether the options should be implemented during the wet season, during the dry season or both.

Many of the options have pieces or components that need to be implemented at different times of the year. Options such as demand reduction, are effective under all conditions. Other options can only work when water levels are above (or below) certain levels. Some of the most effective options may require substantial lead time for planning, coordination, approval and implementation. Options such as weather modification may produce the most water if they are implemented during the wet season when potential rain clouds are plentiful. However, the effects of cloud seeding, for example, may be more measurable if it is conducted during the dry season.

3. Consideration of Overall Costs and Benefits.

Relative benefits and costs of options vary widely. The list of options ranges from actions with little or no cost to actions with high cost. Costs are defined to include environmental effects as well as monetary expenses. The amount of water supply benefit that can be realized from any given option also varies widely and, in some cases, cannot be quantified beforehand.

4. Other considerations. Other conditions, issues or events may play a role in the decision process, such as water quality or environmental effects, economic considerations, violations of Minimum Flow and Level (MFL) criteria, local government or other agency actions or participation, etc.

C. Regional vs. Local Drought Conditions.

Depending on the extent and nature of the drought, actions may be taken on a regional or a local basis. Regional actions involve operation of the canals, structures and reservoirs of the primary water management system. Local options involve area- specific use restrictions or changes to local drainage district or utility operations. Water shortage caused by rainfall deficiency may occur regionwide, may be confined to a particular planning area, or in rare cases, may only affect a particular basin or sub-basin. Whereas a regional drought (such as has occurred in the last two years) may require large scale actions that affect all areas of the District, a local drought may only impact certain wellfields and utilities.

1. Kissimmee Basin.

The two main areas in the Kissimmee River Basin that are of water supply concern to the District are the Orlando Metropolitan area and the Indian Prairie Basin. Assessment of water conditions in the Orlando Area will mainly focus on water levels in the Floridan Aquifer. Assessment of conditions in the Indian Prairie Basin will focus on surface water levels in Lake Istokpoga and connected canals.

In addition, the Lakes in the Upper Kissimmee Chain serve as regional reservoirs. Water conditions in these lakes is assessed on a daily basis, relative to lake regulation schedules, average historic conditions and projected demands. The District, in conjunction with the USACE, has the capability to store or release water from these lakes, within limits established by their regulation schedules and lake management plans, to optimize the regional distribution of water.

2. LEC Planning Area.

Assessment of conditions will be determined based on water levels in Lake Okeechobee, the Water Conservation Areas, coastal canals and the Biscayne aquifer and the potential for saltwater intrusion at critical (at-risk) wellfields. Implementation of water supply contingency options may occur based on local or regional conditions.

3. LWC Planning Area.

Assessment of conditions will be determined based on water levels in Lake Okeechobee, the capacity to provide water deliveries through the Caloosahatchee River, water levels in critical aquifer systems, and the threat of saltwater intrusion in coastal areas

4. UEC Planning Area.

Assessment of conditions is determined based on water levels in Lake Okeechobee, the associated capacity to provide water deliveries through the St. Lucie Canal, water levels in C-23, C-24 and C-25 canals, and the threat of saltwater intrusion in coastal areas.

D. How Options Were Implemented During the Past Two Years

An example of how the process of balancing timing, cost/benefit and drought severity considerations worked during the period from October 1999 to June 2001 is shown graphically in Figure 3 below.

The initial Water Supply Contingency Plan was developed beginning in June 2000 and, due to conditions in Lake Okeechobee, implementation of features of this Plan began immediately, even before the final document was completed.

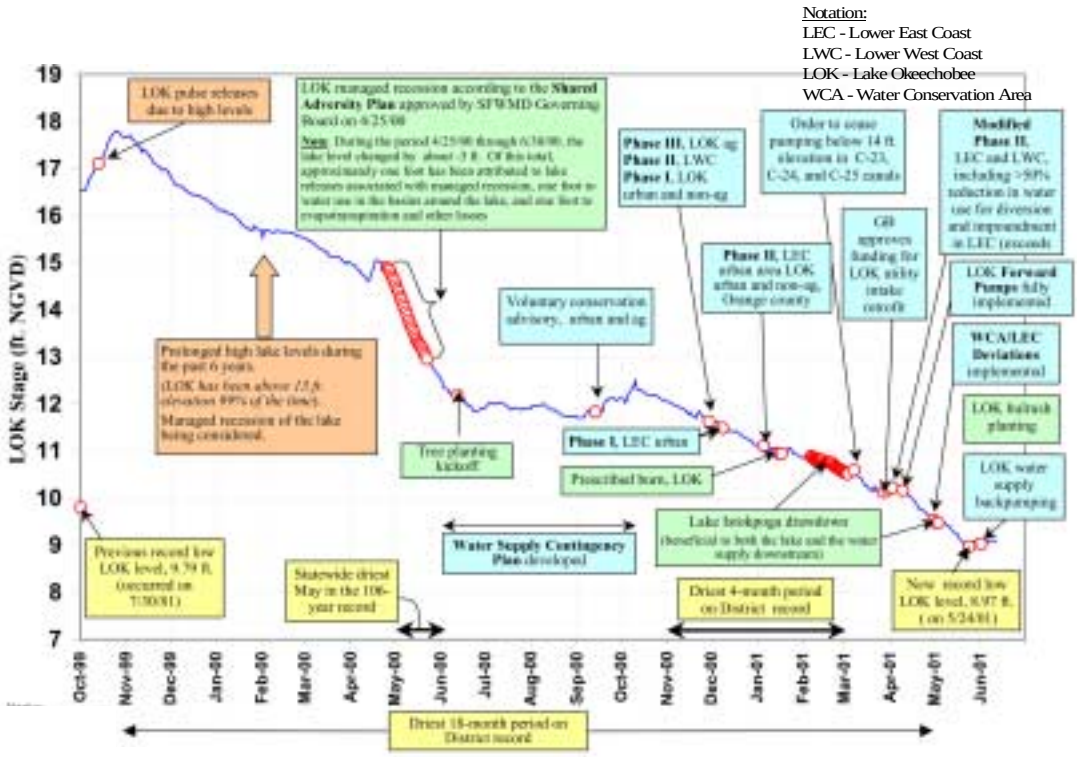

Figure 3. Chronology of Drought Management Actions implemented from October 1999 to June 2001

V. IMPLEMENTATION STRATEGY AND PROCESS

A. Projecting Water Conditions

Projections of water conditions within the District are made periodically throughout the year. When these projections indicate that water levels are declining significantly and/or that rainfall is significantly below normal, computer simulations are made, based on various rainfall assumptions, to evaluate potential future water supplies. Long range forecasts, such as those generated by the National Climate Prediction Center, will be incorporated into projections for water conditions.

A major tool that will be used for this effort is the Lake Okeechobee "Position Analysis" (Obeysekera et al., 1999). The Position Analysis will generate simulations of potential Lake Okeechobee stages based on the current state of the system and historic rainfall patterns that have been analyzed to determine the most likely outcomes, given the rainfall forecast. The Position Analysis will be conducted during the first week of each month. Other types of water condition projections, such as detailed groundwater modeling, may also be incorporated into the water shortage management efforts as appropriate.

B. Formulating Recommendations

The District will conduct monthly Lake Okeechobee Position Analyses and projections of water conditions. The entire range of options will be evaluated for implementation at that time, based on the following considerations:

- Existing water conditions

- Projected water conditions
- Short term and long term weather forecasts
- Current severity of water shortage and demand characteristics
- Time of year
- Option cost and environmental impact
- Water supply benefit
- Input and comments from other agencies, interested parties and the public

Options that are appropriate for implementation will be brought forward by the drought management team. In this manner, recommendations for implementation of options will be made on an iterative basis. Some options may require Executive Director or Governing Board action for implementation, whereas other options may be implemented directly by District staff. A few options will also require approval from other entities prior to implementation.

C. Drought Management Team

The District has established a Drought Management Team under the auspices of the Emergency Operations Center (EOC) in order to develop and implement this Plan. This organizational structure is designed to provide effective direction, control and coordination in response to a wide range of emergency conditions. The organizational structure is flexible, based on which sections need to be activated at a particular time.

As emergency situations threaten or occur, Emergency Management activates the EOC to facilitate evaluation and incident planning as well as implementation of emergency functions and resources. The EOC is key to successful response and recovery operations and therefore can facilitate effective and efficient implementation of the options in this plan. With technical support, policy and decision makers located together in the drought management team, personnel and resources can be used efficiently. Coordination of activities will ensure that all decisions are made and tasks are accomplished quickly, minimizing duplication of efforts.

VI. FUNDING

Many of the options identified in the year 2000 Contingency Plan were costly to implement and were also unbudgeted. The Governing Board authorized $10,134,026 in emergency drought expenditures through August, 2001. These expenditures are itemized in Table 2. Since these expenditures were unbudgeted, a number of funding options were identified to support water shortage operations. All of the expenditures were funded through one or a combination of the following:

a. Incurring short term borrowing

b. Redirecting funds from other programs

c. Deferring FY01 budget priorities

d. Unencumbering funds on existing contracts

e. Using budgeted contingency reserves

Table 2. FY'01 Drought Expenditure Summary as of August 7, 2001

	Board Authorized Amounts	Expended & Obligated Amounts	Remaining Unobligated Amounts
September 14, 2000 Board Authority Given for Drought Purchases			
Forward Pump Acquisition	$2,288,000	$2,371,431	0
Vegetation Management	500,000	100,000	$400,000
Media Buying & Ad Placement	296,000	296,000	0
Water Conservation Education	100,000	100,000	0
Water Quality Testing	50,000	9,400	40,600
Contingency	150,000	0	66,569
March 15, 2001 Board Authority Given for Drought Purchases			
Additional Submersible Pump (forward pumping)	130,000	105,754	24,246
Additional Media Buying & Ad Placement	400,000	400,000	0
Electric (power) Costs for Pumps	227,000	0	227,000
Water Conservation Education Printing & PSA	120,000	100,394	19,606
Improve Bottom Contouring Measurements	68,000	0	68,000
Weekly Additional Charter Helicopter WCA Monitoring	54,000	7,500	46,500
Education (School Districts) Campaign Awards	54,000	54,000	0
Extra Duty Law Enforcement Sweeps	40,000	0	40,000
Newspapers in Education Program (School Districts)	30,000	33,650	-3,650
Improve Water Level Measurements	28,000	2,582	25,418
C-51 Aquadam (Water Containment System)	25,000	13,178	11,822
Water Flow Equipment (Improving Measurements)	20,000	20,000	0
Water Conservation Handouts	15,000	0	15,000
Education Campaign & Outreach Survey	10,000	11,170	-1,170
Printing Water Enforcement Tickets	10,000	9,229	771
Enforcement Supplies (for District Personnel)	2,000	0	2,000
MARCH 27 and MAY 10, 2001 Board Authority Given for Drought Purchases			
South Bay Utility	27,845	27,845	0
Pahokee Utility	465,000	551,131	0
Clewiston Utility	340,000	345,100	0
Belle Glade Utility	305,000	437,250	0
Okeechobee Utility	573,724	616,112	0
Utility contingency amount (unanticipated costs)	285,731	0	19,862
Additional Media Buying & Ad Placement	250,000	106,056	143,944
Environmental Monitoring, Data Acquisition/ Modeling	520,000	450,000	70,000
G-94C Culvert Replacement	250,000	189,600	60,400
Phone Bank Temporary Personnel	17,500	23,777	-6,277
Forward Pump Operational Costs (Electricity)	100,000	0	100,000
JULY 11, 2001 **Board Authority Given for Drought Purchases**			
Lake Okeechobee Augmentation Project	300,000	4,900	295,100
Automation of G-123	20,000	0	20,000
Rain Gauge & Weather Stations (supply-side ops)	75,000	75,000	
PURCHASES SUBTOTALS	**$8,146,800**	**$6,482,871**	**$1,663,929**
Cost of drought related District employee payroll & benefits (as of 6-27-01)	$**1,987,226**		
TOTAL AUTHORIZED DROUGHT AMOUNT	**$10,134,026**		

As we move forward with the next iteration of the Water Supply Contingency Plan, additional expenditures have been identified and have been incorporated into the FY02 budget. Budgeted items are listed in Table 3.

Table 3. FY02 Drought Budgeted Expenditures

Items	Amount
Fisheating Bay Excavation	$2,200,000
Personal Services	1,305,365
SA 1748 LO Industrial Canal Dredging	500,000
Media Services	500,000
Media Managerial Reserves	500,000
Electrical	311,500
Fuel	259,150
SA 1748 LO Pahokee Harbor Dredging	250,000
GSC-Monitoring Plan/Data Eval	136,000
Misc. Culverts	52,332
USGS COOP ET Station WCA/ENP	42,500
USGS Kissimmee Basin	28,576
SA 1748 LO Bulrush Planting	20,000
Groundwater Conditions Report	14,606
Parts Supplies	9,600
Incubator for Biological Monitoring	7,000
Wading Rod Field Equipment	6,685
SA 1748 LO Microscope	5,200
Backpumping, Biomonitoring	5,000
SA 1748 LO Habitat Restoration	2,500
TOTAL	**$ 6,159,014**

VII. REFERENCES

Obeysekera, J.A., Paul Trimble, Luis Cadavid,., Ray Santee, and Cary White. 1999. Use of Climate Outlook for Water Management in South Florida, USA. South Florida Water Management District (http://www.sfwmd.gov) , West Palm Beach, Florida 33416, USA.